

Atty. Docket No. 03AB118A

SYSTEMS AND METHODS THAT UTILIZE
SCALABLE VECTOR GRAPHICS TO PROVIDE
WEB-BASED VISUALIZATION OF A DEVICE

by

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MAIL CERTIFICATION

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Related Applications

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The present invention generally relates to industrial control systems, and more particularly to systems and methods that provide remote visualization of an industrial device *via* scalable vector graphics.

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and executed within an address bar of a web browser, an HTTP command is transmitted to a Web server that obtains and returns a requested Web page(s). Simple Mail Transfer Protocol (SMTP) is generally utilized for transmitting electronic mail (e-mail) messages between servers, wherein the messages can be retrieved with an e-mail client *via* Post Office Protocol (POP) or Internet Message Access Protocol (IMAP). In addition, SMTP is generally utilized to convey messages from an e-mail client to a mail server. File Transfer Protocol (FTP) is commonly utilized for exchanging files, for example, for downloading a file from a server to a client and/or uploading a file from a client to a server.

As the World Wide Web becomes more ubiquitous, Web-based interfaces are becoming a preferred means to remotely interact with systems and devices over networks (*e.g.*, intranets, internets and the Internet). For example, Web-based interfaces (*e.g.*, a Web page implemented with a Web browser) have been developed to monitor and control entities such as security systems, video/audio entertainment centers, electromechanical equipment, *etc.*, as well as monitor internal and/or external locations. In another example, Web-based interfaces have been developed to facilitate communication with industrial systems and devices such as industrial controllers, for example.

Such Web-based interfaces typically include graphics, audio, text, video and the like and often require powerful rendering engines, banks of available memory, and proprietary software and hardware. In addition, many conventional systems comprise complex architectures, cannot be shared amongst third parties, consume resources for development and implementation, lack flexibility, consume processing power, and do not support many commonly utilized off-the-shelf software applications.

By way of example, to render a Web page with graphics conventional systems typically download and render one or more image files (*e.g.*, GIF, TIF, BMP, JPEG, *etc.*); download and execute one or more Java applets and/or applications in connection with the Web browser; and/or download formatted information (*e.g.*, PDF, word processing, *etc.*) that is displayed within one or more applications invoked within the Web browser. Downloading and utilizing such files and applications can consume bandwidth, processing cycles, time and memory and adds overhead. In addition, downloaded images

generally are resolution dependent such that a specified image size is maintained rather than scaling the image to conform to an area of a viewing window; and thus, such images reduce Web page presentation flexibility. Moreover, the content within such image files typically cannot be searched or include active inks (*e.g.*, hyperlinks) to other web sources.

Summary of the Invention

The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is intended to neither identify key or critical elements of the invention nor delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

The present invention relates to systems and methods that provide a simple remote Web-based interface to networked industrial devices. The novel interface is based on a scalable vector graphics (SVG) XML markup language, which is supported by many known Web browsers (*e.g.*, *via* an SVG plug-in). Thus, the systems and methods of the present invention mitigate the need for proprietary software and/or hardware, specialized rendering engines and/or peripheral utilities such as Java applets and applications. In addition, SVG XML markup language provides for rendering (*via* basic ASCII drawing commands) resolution independent images that can include searchable graphics, text, labels, descriptions, *etc.*, and links to other information; thus, employing SVG XML markup language can mitigate the need to download images and files with graphics and execute associated applications. The foregoing enables a user to represent a portion of a device, for example a device's faceplate, in an XML markup language file pursuant the SVG syntax, wherein a Web browser and/or an open source software package such as Adobe, Macromedia, *etc.* can be utilized to draw the portion of the device within a viewing window of the Web browser and/or an open source software package. In addition, the user can interact with the graphical representation to change values that effect device operation and/or monitor a device's performance.

In one aspect of the present invention, a system is provided that enables remote access to a device *via* a graphical depiction of various device features and/or related information based on a representation of the device embedded within an associated SVG file. The system includes a Web-based interface that can retrieve one or more Scalable Vector Graphics (SVG) XML markup language files generated for the device from a data store associated with the device. The retrieved SVG file can be executed locally in connection with the Web-based interface *via* ASCII drawing commands, wherein vector images can be created to render device-related graphics and/or text within the Web-based interface or an invoked open software package. Advantages of employing such a novel technique include reducing overhead and bandwidth requirements; mitigating downloading image files (*e.g.*, BMP, GIF, TIF, JPG, *etc.*); mitigating downloading and executing applications such as Java applets; and rendering graphics that are resolution independent and searchable. The foregoing can be exploited within an industrial setting to visualize device (*e.g.*, controller, PLC, *etc.*) related information (*e.g.*, the device's faceplate) from a remote Web interface.

In another aspect of the present invention, a system for retrieving and executing an SVG file associated with a device is provided. The system includes a network manager that can be accessed *via* any Web-based interface. The network manager facilitates locating and retrieving SVG files, which can be subsequently executed within the Web-based interface and/or associated open software package such as Adobe and Macromedia applications. The SVG file can include instructions that can be executed *via* ASCII drawing commands to render graphical depictions of a device (*e.g.*, a faceplate). A user can interact with the rendered depictions to observe device performance and effectuate device operation. The system can optionally include a firewall to provide secure communication between the Web-based interface and the device.

In yet another aspect of the present invention, exemplary user interfaces that can be employed in connection with various novel aspects of the invention are illustrated. A first user interface depicts a graphical representation of device information related to asset management maintenance. Such information can include: a region for noting device description, location, maintenance history, and device condition; a region to indicate equipment load information; a region that provides information related to fuel

consumption; and a region that denotes performance. A second user interface depicts a graphical representation of device performance *via* a graph and device parameters, and a mechanism to load values and view information *via* a chart, for example.

In still another aspect of the present invention, methodologies are provided that provide access to device-related information from a remote Web interface. The methodologies include employing a Web-based interface to remotely obtain an SVG file associated with a device of interest, wherein the obtained file is subsequently executed to generate a graphical display illustrating various aspects of a device. A user can employ the rendered display to interact with the device, for example, to monitor (*e.g.*, *via* charts graphs, values, *etc.*) and control (*e.g.*, *via* loading parameters) performance. The SVG file can be executed locally *via* basic ASCII drawing commands, wherein vector images can be generated to render device-related graphics and/or text within the Web-based interface or an open software package.

In various other aspects of the present invention, intelligence can be employed to facilitate the system and methods. Such intelligence can include employing statistics, probabilities, inferences, and/or classifiers.

The following description and the annexed drawings set forth in detail certain illustrative aspects of the invention. These aspects are indicative, however, of but a few of the various ways in which the principles of the invention may be employed and the present invention is intended to include all such aspects and their equivalents. Other advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the drawings.

Brief Description of the Drawings

FIG. 1 illustrates an exemplary system that provides remote graphical access to device-related information, in accordance with an aspect of the present invention.

FIG. 2 illustrates an exemplary system that renders device-related information within a Web-based interface associated with a remote Web client, in accordance with an aspect of the present invention.

FIG. 3 illustrates a first exemplary SVG-based interface, in accordance with an aspect of the present invention.

FIG. 4 illustrates a second exemplary SVG-based interface, in accordance with an aspect of the present invention.

FIG. 5 illustrates an exemplary methodology that executes device SVG files within a Web interface, in accordance with an aspect of the present invention.

5 FIG. 6 illustrates an exemplary methodology that renders graphics associated with an SVG file to provide a user a mechanism to interact with a device from a Web interface, in accordance with an aspect of the present invention.

FIG. 7 illustrates a first exemplary environment wherein the novel aspects of the invention can be employed.

10 FIG. 8 illustrates a second exemplary environment wherein the novel aspects of the invention can be employed.

Detailed Description of the Invention

15 The present invention provides a novel Web-based approach to interact with devices within an industrial environment. The systems and methods employ an interface that is based on a scalable vector graphics (SVG), which is an XML markup language supported by installing an SVG plug-in in connection with known Web browsers. By way of example, a device's faceplate can be represented *via* an SVG file and stored with the device. A user can employ a Web browser from a remote location (*e.g.*, *via* a Web client) to retrieve the SVG file, wherein the file can be loaded and executed within the Web browser and/or an open source software package (*e.g.*, Adobe, Macromedia, *etc.*) in connection with the Web browser. Execution can comprise rendering an interactive faceplate that can include illustrations of LEDs, alphanumeric displays, inputs, output, *etc.*, trending mechanisms (*e.g.*, graphs, charts, *etc.*), and capabilities to change values that effectuate device performance. In another example, ladder logic can be additionally and/or alternatively represented within an SVG file.

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30 The present invention is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It may be evident, however, that the present invention may be practiced without these specific details. In

other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing the present invention.

As used herein, the terms “component,” “device,” “controller,” and the like are intended to refer to a computer-related entity, either hardware, a combination of hardware and software, software, or software in execution. For example, a component can be, but is not limited to, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, a microprocessor, a processing unit and/or a computer. In addition, one or more components can reside within a process and/or thread of execution and a component can be localized on a computer and/or distributed amongst a plurality of computers. Furthermore, such components can be executed within various computer readable media, wherein respective media can be associated with disparate data structures. Moreover, such components can communicate *via* local and/or remote processes, for example, in accordance with a signal with one or more data packets (*e.g.*, data from a component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems *via* the signal).

FIG. 1 illustrates a system 100 that provides access to device-related information from a Web-based interface, in accordance with an aspect of the present invention. The system 100 comprises a data bank 110 that can store files with embedded device-related information and a Web-based interface 120 that can retrieve one or more files from the data bank 110 and can facilitate rendering the information for presentation to a user.

As briefly noted, the data bank 110 can be utilized to store files that include device-related information. Such files can be XML-based and typically are created utilizing XML markup language Scalable Vector Graphics (SVG) syntax. Employing SVG provides a mechanism wherein graphics (*e.g.*, two and three dimensional images) and/or text can be represented within a file that can be executed *via* simple ASCII drawing commands in order to display the graphics and/or text within the Web-based interface. In general, SVG enables vector images to be generated through text-based commands formatted to comply with XML specifications.

Thus, a remote user can access the data bank 110, retrieve an SVG file associated with a device of interest, and render the SVG file in connection with the remote Web-based interface 120 *via* ASCII drawing commands. Advantages of employing SVG

include resultant graphics that are resolution independent such that the graphics can be scaled to conform to a viewing window and can include searchable information. The foregoing can be exploited within an industrial setting, wherein a device's faceplate can be represented within an SVG file and subsequently obtained and rendered to present a dynamic faceplate to a user through a remote Web interface. Such a faceplate can be a virtual representation of the device's physical faceplate, including LEDs, alphanumeric displays and/or other visual indications of the devices status and operations. In addition, the faceplate can be automatically updated (*e.g.*, in real-time) to reflect the actual state of the physical faceplate.

Conventionally, device-related graphics are provided *via* images (*e.g.*, GIF, JPG, TIF, BMP, *etc.*) that are downloaded to a remote Web interface, which can consume bandwidth and memory and increase overhead. In addition, such downloaded images typically cannot be searched and are resolution dependent, wherein the viewable size defined and cannot be scaled according to a display window. In many instances, applications such as Java applets and/or applications are additionally or alternatively downloaded and executed to render graphics. Such applications can likewise consume bandwidth and memory and increase overhead. Moreover, such images and/or Web applications can require specialized software and/or hardware, rendering engines and/or peripheral utilities. Thus, the present invention provides a novel approach that can improve conventional techniques for displaying graphic representative of a device to a user employing a remote interface.

Stored SVG files can be managed within the data bank 110 *via* various techniques. For example, in one aspect of the present invention a user can generate an SVG file(s) for a device and subsequently load the SVG file(s) to the data bank 110. For example, the user can establish a connection to the data bank 110 and save the file within the data bank 110. In another example, the data bank 110 can be configured to periodically check for newly created and/or updated SVG files (*e.g.*, dynamically generated), and if such a file is located, the SVG file can be automatically retrieved and stored within the data bank 110. In yet another instance, SVG files can be loaded to the data bank 100 from portable media such as CD, DVD, optical disk, tape, floppy disk, flash memory, and the like. In still another instance, wireless technology can be

employed to transfer a SVG file to the data bank 110. It is to be appreciated that rather than retrieving such information from the data bank 110, a stream(s) of SVG information can be conveyed.

In another aspect of the present invention, a user can remove a SVG file(s) from the data bank 110 *via* similar mechanisms. For example, the user can establish a connection to the data bank 110 and delete a SVG file stored within the data bank 110. In another example, the data bank 110 can be configured to periodically remove outdated and/or unused SVG files. In yet another instance, an uninstall utility can be employed to selectively and automatically remove SVG files from the data bank 110. It is to be appreciated that standard security mechanisms (*e.g.*, login, password, *etc.*) can be employed to enable the adding and/or removing of files, as well as other common actions such as viewing, editing, *etc.*

The Web-based interface 120 can be utilized to access SVG files stored within the data bank 110. Thus, a user can employ the Web-based interface 120 to add and/or remove SVG files from the data bank 110. In addition, the user can employ the Web-based interface 120 to retrieve an SVG file from the data bank 110 and subsequently execute the SVG file, wherein execution can include rendering a graphical display that depicts various aspects of the device (*e.g.*, an associated faceplate) and includes mechanisms to observe performance and change values that effectuate device operation. As noted previously, utilizing SVG syntax enables execution *via* basic ASCII drawing commands. Thus, an SVG XML-based file can be obtained and locally executed to draw graphics, which can mitigate the overhead and expense of downloading image files (*e.g.*, BMP, GIF, TIF, JPG, *etc.*). It is to be appreciated that the remote Web-based interface 120 can be a Web browser and/or open software package such as an Adobe, Macromedia, *etc.* software application, as described in detail below.

In one aspect of the present invention, the system 100 can be employed in an industrial environment. For example, an SVG file can be generated for an industrial device (*e.g.*, controller, PLC, *etc.*) and stored within the data bank 110 and/or dynamically generated *via* a stream of information. A user can employ a Web client to access a network associated with the device. Such access can be over an intranet, an internet and/or the Internet and can be through wire, optical, IR or RF technologies, for

example. The user can launch the remote Web-based interface 120 and utilize the remote Web-based interface 120 to access the data bank 120, wherein the user can retrieve an SVG file associated with the industrial device. The SVG file can be executed to render the file content within a display associated with the remote Web-based interface 120 and/or within an associated application (*e.g.*, plug-ins for Adobe, Macromedia, *etc.*). Such rendering can be an interactive graphical representation that is updated in real-time. The user can interact with the device *via* the rendering in order to view device-related information (*e.g.*, performance, manuals, history, *etc.*) and/or effectuate the device's operation. In addition, the user can capture and save screens, for example, for future playback and/or analysis, and/or operator actions.

It is to be appreciated that a typical industrial device that can be represented to a user *via* an SVG file comprises a plurality of modules (*e.g.*, a programmable logic controller, or PLC) such as a control module(s), an interface module(s) and an I/O module(s) utilized in connection with electrical, mechanical, hydraulic and pneumatic systems and processes. Control commonly is achieved *via* virtual relays, contactors, counters, timers and other means through hardware, software and/or firmware that can be user (*e.g.*, user written, application specific code) configured. I/O provides a mechanism for communication between systems and the environment. For example, an input channel can be employed to receive analog and digital signals through sensors, switches and the like that provide information indicative of state(s) (*e.g.*, on/off) and/or relating to a process(s). An output channel can be employed to convey a next state to an instrument under the control of the controller. Such industrial devices can be utilized to semi and/or fully automate factories.

FIG. 2 illustrates a system 200 that renders device-related information within a Web-based interface associated with a remote Web client, in accordance with an aspect of the present invention. The system 200 can be interfaced to a Web client 210 that can be provided with access to device-related information *via* a network manager 220. The Web client 210 can be essentially any microprocessor-based system that can interface with a network. For example, the Web client 210 can be a personal computer (*e.g.*, desktop, mini-tower and tower), a mainframe computer, a laptop, a notepad, a palm pilot, a handheld, a tablet PC, a personal data assistant, cell phone, a terminal (*e.g.*, "dumb"

terminal), an HMI, and the like. In addition, the Web client 210 can include off-the-shelf and/or specialized (*e.g.*, proprietary) software and/or hardware such as accelerators, dedicated processing chips and high-speed communication channels that can increase performance, enhance user capabilities, increase transmission and rendering rates and improve aesthetics. Furthermore, firmware can be utilized to provide low-level executable instructions, parameters and/or control code, and provide a flexible means to upgrade and/or revise hardware functionality and performance.

A user can invoke a Web-base interface from the Web client 210, wherein the Web-based interface can facilitate interaction between the Web client 210 and any device residing on an available network. The Web-based interface can comprise an application or a portion of an application executing in connection with one or more components. For example, the Web-based interface can be code executing within one or more of the aforementioned microprocessor-based components, wherein the code can reside in local memory such as any suitable type of RAM or ROM, virtual memory, hard disk, *etc.* and/or an external storage such as CD, DVD, optical disk, floppy disk, tape, memory stick, portable hard drive, *etc.*

In one aspect of the present invention, the Web-based interface can be a graphical user interface (GUI) or Web browser. As such, the Web-based interface can comprise mechanisms (*e.g.*, input and output) that facilitate communication and/or interaction over a network. For example, the Web-based interface can comprise text and/or graphic presenting (*e.g.*, output) regions comprising dialogue boxes, static controls, drop-down-menus, list boxes, pop-up menus, and graphic boxes. The presenting regions can further include utilities to facilitate display. For example, the presenting regions can include vertical and/or horizontal scroll bars to facilitate navigation and toolbar buttons to determine whether a region will be viewable, and to adjust zoom, orientation and/or color/gray scale. A user can interact with the presenting regions to view, select and provide information *via* various devices such as a mouse, a roller ball, a keypad, a keyboard, a pen and/or voice activation, for example.

Input regions utilized to transmit information can employ similar mechanisms (*e.g.*, dialogue boxes, *etc.*) and, in addition, utilities such as edit controls, combo boxes, radio buttons, check boxes and push buttons, wherein the user can employ various input

devices (*e.g.*, the mouse, the roller ball, the keypad, the keyboard, the pen and/or voice activation) in connection with the mechanism and utilities. For example, the user can provide a parameter or variable, or pointer thereto (*e.g.*, a register location) *via* entering the information into an edit control box and/or highlighting an associated check box.

5 Typically, a mechanism such as a push button is employed subsequent to entering the information in order to initiate conveyance of the information. However, it is to be appreciated that the invention is not so limited. For example, merely highlighting the check box can initiate information conveyance.

10 The input and output mechanisms can be employed for various communication such as email, chat room, instant messaging, *etc.* In addition, URLs and/or hyperlinks can be utilized to locate and/or specify locations of information. Help files, debuggers, troubleshooting documentation and/or automatic event (*e.g.*, error) loggers can be linked for manual and/or automatic invocation. Applications such as word processors, data analysis, scheduling utilities, project planners, *etc.* can be launched from drop-down
15 menus, shortcuts and/or buttons.

In addition or alternatively, the Web-based interface can include command-line functionality. For example, a command line can be employed to prompt for information *via* a text message and/or audio tone. The operator can then provide suitable information, such as alpha-numeric input corresponding to an option provided in the interface prompt
20 or an answer to a question posed in the prompt. In another aspect of the present invention, a value, set of values or a stream of values can be presented to the user in the command line interface.

It is to be appreciated that the Web-based interface can be generated in connection with an application programmer interface (API). As known, APIs facilitate building
25 software applications *via* a set of routines, protocols, and tools, wherein developers and/or programmers can employ the API to construct customized applications consistent with the operating environment and a user(s) needs. In one aspect of the present invention, an SDK programming package, which typically includes one or more APIs and programming tools (including documentation), can be employed to develop the Web-
30 based interface.

The Web client 210 can utilize the Web-based interface to communicate with the network manger 220. The network manager 220 can facilitate locating a device 230 (e.g., an industrial device, as described above) and conveying information (e.g., an SVG-based file) between the Web client 210 and the device 230 and/or associated storage. For example, the Web-based interface can upload and/or download SVG files, streams of SVG information, manuals, history files, and the like from/to the device 230 *via* the network manager 220. As described previously, an SVG file and/or stream of SVG information can include instructions for rendering graphics that depict various aspects of a device, wherein the instruction can be executed *via* basic ASCII commands. Thus, the Web-based interface can be employed to obtain and render an SVG file that depicts dynamic graphical aspects (e.g., a faceplate, LEDs, alphanumeric displays, state, status, inputs, output, *etc.*, trending mechanisms (e.g., graphs, charts, *etc.*), and capabilities to change values that effectuate device performance) of the device 230. The foregoing provides an improvement over conventional techniques, wherein graphics generally are downloaded as image files. Moreover, and unlike downloaded image files, graphics rendered from a SVG file are resolution independent and can be scaled to a display window and can be searched for text and other alphanumeric characters.

The storage component 240 can be utilized to save device-related SVG files. The storage component 240 can be any known storage element. For example, it can be local memory. For example, it can include storage associated with a hard drive, RAM, ROM, a memory module, flash, CD, DVD, and the like. In addition, it can include shared, or common storage such a networked server and/or database that is local to an associated network. Remote storage can include remote servers, databases and/or other devices.

A firewall 250 can be utilized to provide a secure interface to the device 230 and storage component 240. For example, the firewall 250 can ensure that only authorized users access the device 230 and storage component 240. It is to be appreciated that any known firewall technique can be employed in accordance with an aspect of the present invention. For example, in one instance, a logon and password can be utilized to facilitate security. In another instance, user characteristics such as a fingerprint, a facial characteristic, and/or an iris map can be employed. Moreover, it is to be appreciated that

the device 230 can provide for security, for example, requiring a login and/or password in order to gain access.

FIGs. 3 and 4 illustrate exemplary user interfaces that can be employed in connection with the novel aspect of the present invention. It is to be appreciated that such interfaces are provided for illustrative purposes and are not limitative. Thus, various other user interfaces can be employed in accordance with an aspect of the present invention.

Proceeding to FIG. 3, an exemplary user interface 300 that can be employed in connection with the novel aspect of the present invention is illustrated. As depicted, the exemplary user interface 300 provides device information related to asset management maintenance. For example, user interface 300 comprises a region 305 with a plurality of entries for device description, location, maintenance history, and device condition. A device description entry 310 can be utilized to provide a brief narrative (*e.g.*, Engine Driven Air Compressor) of the device; a device location entry region 315 can be utilized to provide the building (*e.g.*, Power Building), section (*e.g.*, Section B), and row (*e.g.*, Row 1), for example, where the device can be found; a last maintenance entry 320 can be utilized to provide a history (*e.g.*, 9/3/03) of when the last maintenance was performed and a device condition entry 325 that can indicate whether the device is due for maintenance (*e.g.*, MAINTENANCE DUE). In addition, the region 305 can include a maintenance invocation mechanism 330 that allows a user to manually initiate device maintenance.

The user interface 300 further comprises a region 335 with a plurality of entries that provide equipment load information. An on time duration entry 340 can be utilized to provide a time in hours, minutes and/or seconds (*e.g.*, 953 hours); a cycles completed entry 945 can be utilized to indicate the total number of cycles completed (*e.g.*, 1732293) since the last maintenance; and a total cycles completed entry 950 can be utilized to indicate the lifetime number of cycles completed (*e.g.*, 1752666). The user interface 300 further comprises a region 355 that provides information related to fuel consumption. A fuel consumption entry 360 can be utilized to indicate the fuel consumed during a year, month, day, *etc.* (*e.g.*, 123 therms/Day), as well as additional information such as whether the amount of consumption is normal (*e.g.*, NORMAL). The user interface 300 further

comprises a region 365 that indicates performance. A power entry 370 can be utilized to denote the power expended (*e.g.*, 109 HP) and whether such expenditure is normal (*e.g.*, EXCESS); a speed entry 375 can be utilized to indicate the average speed (*e.g.*, 325) and whether such speed is normal (*e.g.*, NORMAL); and a rating entry 380 that can be
5 utilized to denote the efficiency rating (*e.g.*, 84%). In addition, the user interface 300 can further comprise a device selecting mechanism 385, an emailing mechanism 390 and a return to home mechanism 395.

FIG. 4 illustrates an exemplary user interface 400 that can be employed in connection with the novel aspect of the present invention is illustrated. As depicted, the
10 exemplary user interface 400 illustrates device performance *via* a graph 410 and device parameters. The graph 410 can represent process history. For example, a Y axis (ordinate) can be utilized to indicate the number of units processed and an X axis (abscissa) can be utilized to determine the number of units processed throughout a day. A value 420 and a value 430 can be automatically retrieved *via* a get mechanism 440 or
15 manually set *via* a load mechanism 450. In addition, a scroll bar 460 is provided to navigate through a display that is larger than the viewable area. The user interface 400 further comprises a mechanism 470 that provides a link to additional information.

FIGs. 5 and 6 illustrate methodologies, in accordance with an aspect the present invention. While, for purposes of simplicity of explanation, the methodologies are shown
20 and described as a series of acts, it is to be understood and appreciated that the present invention is not limited by the order of acts, as some acts can, in accordance with the present invention, occur in different orders and/or concurrently with other acts from that shown and described herein. For example, those skilled in the art will understand and appreciate that a methodology could alternatively be represented as a series of
25 interrelated states or events, such as in a state diagram. Moreover, not all illustrated acts may be required to implement a methodology in accordance with the present invention.

Proceeding to FIG. 5, a methodology 500 is illustrated that provides access to device-related information from a remote Web interface, in accordance with an aspect of the present invention. It is to be appreciated that the system 500 can be employed within
30 an industrial setting to remotely visualize a device (*e.g.*, performance, a faceplate, *etc.*) utilizing Scalable Vector Graphics (SVG).

At reference numeral 510, an SVG XML file is generated for a device. As described *supra*, utilizing the XML markup language Scalable Vector Graphics (SVG) syntax provides for representing device graphics as well as text within a file that can be executed *via* ASCII drawing commands at a client machine. Thus, a remote user can retrieve a device's SVG file *via* a Web browser and render interactive graphics and/or text within the browser rather than download one or more graphics files (*e.g.*, GIF, JPG, TIF, *etc.*) and/or executable applications such as Java applets and/or applications. Such graphics can be refreshed to provide the user with a representation that reflects the actual state of the physical entity graphically depicted. In addition, the rendered graphics can be searched and include links to other files. Moreover, the rendered graphics can be resolution independent, wherein a user and/or an automatic mechanism can scale the graphics within a viewing region. The foregoing provides for various benefits over conventional systems and techniques, as described in detail above.

At 520, the generated SVG file can be stored with the device. As noted above, various mechanisms can be employed to transfer an SVG file to storage associated with the device. For example, the SVG file can be locally and/or remotely uploaded, downloaded and/or removed. In addition, manual and/or automatic techniques can be employed. At reference numeral 530, a user can access the SVG file from a Web interface. For example, a user can log on to a Web client, establish a session with a network, launch a network browser, and obtain the SVG over the network.

At 540, the user can execute the SVG file. The executed file can provide the user with device related information such as performance and graphical representations of the device. The user can interact with the graphical display to obtain device information and effect parameters that can alter device performance. It is to be appreciated that retrieving such files and configuring values can be facilitated *via* intelligence. For example, the intelligence can be employed to facilitate determining what information may be important to the user and how to display information. In addition, the intelligence can be employed to facilitate determining parameter changes. Moreover, the intelligence can be employed to facilitate searching and returning results, including sorting and/or filtering the data. Such intelligence can render decisions automatically and/or semi-automatically, wherein the user can be prompted to participate in various aspects of decision-making. It

is noted that the intelligence can be based on statistics, probabilities, inferences and classifiers (*e.g.*, explicitly and implicitly trained), including Bayesian learning, Bayesian classifiers and other statistical classifiers, such as decision tree learning methods, support vector machines, linear and non-linear regression and/or neural networks can be employed in accordance with an aspect of the present invention.

FIG. 6 illustrates a methodology 600 to interact with a device *via* information graphically rendered within a Web interface, in accordance with an aspect of the present invention. At reference numeral 610, a user logs on to a client with access to a network associated with a device the user desires to interact with over the network. The client can be virtually any microprocessor-based system (as describe in detail above).

The client can include a network browser that facilitates communication over a network. At 620, the user can employ the network browser to access a device residing on the network. In many instances, the device will be associated with a security mechanism, which can be utilized to prevent unauthorized users from accessing the device. At reference numeral 630, the user can download an SVG file associated with the device, wherein the instructions within the SVG file can be executed to render graphical and/or textual information within the network browser. At 640, the user can interact with the device *via* the graphical and/or textual display to obtain performance-related information and/or effect operation.

In order to provide a context for the various aspects of the invention, Figures 7 and 8 as well as the following discussion are intended to provide a brief, general description of a suitable computing environment in which the various aspects of the present invention can be implemented. While the invention has been described above in the general context of computer-executable instructions of a computer program that runs on a computer and/or computers, those skilled in the art will recognize that the invention also can be implemented in combination with other program modules. Generally, program modules include routines, programs, components, data structures, *etc.* that perform particular tasks and/or implement particular abstract data types.

Moreover, those skilled in the art will appreciate that the inventive methods may be practiced with other computer system configurations, including single-processor or multiprocessor computer systems, mini-computing devices, mainframe computers, as

well as personal computers, hand-held computing devices, microprocessor-based or programmable consumer electronics, and the like. The illustrated aspects of the invention may also be practiced in distributed computing environments where task are performed by remote processing devices that are linked through a communications network.

5 However, some, if not all aspects of the invention can be practiced on stand-alone computers. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

Fig. 7 is a schematic block diagram of a sample-computing environment 700 with which the present invention can interact. The system 700 includes one or more client(s) 710. The client(s) 710 can be hardware and/or software (*e.g.*, threads, processes, computing devices). The system 700 also includes one or more server(s) 730. The server(s) 730 can also be hardware and/or software (*e.g.*, threads, processes, computing devices). The servers 730 can house threads to perform transformations by employing the present invention, for example. One possible communication between a client 710 and a server 730 can be in the form of a data packet adapted to be transmitted between two or more computer processes. The system 700 includes a communication framework 750 that can be employed to facilitate communications between the client(s) 710 and the server(s) 730. The client(s) 710 are operably connected to one or more client data store(s) 760 that can be employed to store information local to the client(s) 710. Similarly, the server(s) 730 are operably connected to one or more server data store(s) 740 that can be employed to store information local to the servers 730.

With reference to Fig. 8, an exemplary environment 810 for implementing various aspects of the invention includes a computer 812. The computer 812 includes a processing unit 814, a system memory 816, and a system bus 818. The system bus 818 couples system components including, but not limited to, the system memory 816 to the processing unit 814. The processing unit 814 can be any of various available processors. Dual microprocessors and other multiprocessor architectures also can be employed as the processing unit 814.

The system bus 818 can be any of several types of bus structure(s) including the memory bus or memory controller, a peripheral bus or external bus, and/or a local bus using any variety of available bus architectures including, but not limited to, 11-bit bus,

Industrial Standard Architecture (ISA), Micro-Channel Architecture (MSA), Extended ISA (EISA), Intelligent Drive Electronics (IDE), VESA Local Bus (VLB), Peripheral Component Interconnect (PCI), Universal Serial Bus (USB), Advanced Graphics Port (AGP), Personal Computer Memory Card International Association bus (PCMCIA), and
5 Small Computer Systems Interface (SCSI).

The system memory 816 includes volatile memory 820 and nonvolatile memory 822. The basic input/output system (BIOS), containing the basic routines to transfer information between elements within the computer 812, such as during start-up, is stored in nonvolatile memory 822. By way of illustration, and not limitation, nonvolatile
10 memory 822 can include read only memory (ROM), programmable ROM (PROM), electrically programmable ROM (EPROM), electrically erasable ROM (EEPROM), or flash memory. Volatile memory 820 includes random access memory (RAM), which acts as external cache memory. By way of illustration and not limitation, RAM is available in many forms such as synchronous RAM (SRAM), dynamic RAM (DRAM),
15 synchronous DRAM (SDRAM), double data rate SDRAM (DDR SDRAM), enhanced SDRAM (ESDRAM), Synchlink DRAM (SLDRAM), and direct Rambus RAM (DRRAM).

Computer 812 also includes removable/non-removable, volatile/non-volatile computer storage media. Fig. 8 illustrates, for example a disk storage 824. Disk storage
20 824 includes, but is not limited to, devices like a magnetic disk drive, floppy disk drive, tape drive, Jaz drive, Zip drive, LS-100 drive, flash memory card, or memory stick. In addition, disk storage 824 can include storage media separately or in combination with other storage media including, but not limited to, an optical disk drive such as a compact disk ROM device (CD-ROM), CD recordable drive (CD-R Drive), CD rewritable drive
25 (CD-RW Drive) or a digital versatile disk ROM drive (DVD-ROM). To facilitate connection of the disk storage devices 824 to the system bus 818, a removable or non-removable interface is typically used such as interface 826.

It is to be appreciated that Fig. 8 describes software that acts as an intermediary between users and the basic computer resources described in suitable operating
30 environment 810. Such software includes an operating system 828. Operating system 828, which can be stored on disk storage 824, acts to control and allocate resources of the

computer system 812. System applications 830 take advantage of the management of resources by operating system 828 through program modules 832 and program data 834 stored either in system memory 816 or on disk storage 824. It is to be appreciated that the present invention can be implemented with various operating systems or combinations of operating systems.

A user enters commands or information into the computer 812 through input device(s) 836. Input devices 836 include, but are not limited to, a pointing device such as a mouse, trackball, stylus, touch pad, keyboard, microphone, joystick, game pad, satellite dish, scanner, TV tuner card, digital camera, digital video camera, web camera, and the like. These and other input devices connect to the processing unit 814 through the system bus 818 *via* interface port(s) 838. Interface port(s) 838 include, for example, a serial port, a parallel port, a game port, and a universal serial bus (USB). Output device(s) 840 use some of the same type of ports as input device(s) 836. Thus, for example, a USB port may be used to provide input to computer 812, and to output information from computer 812 to an output device 840. Output adapter 842 is provided to illustrate that there are some output devices 840 like monitors, speakers, and printers, among other output devices 840, which require special adapters. The output adapters 842 include, by way of illustration and not limitation, video and sound cards that provide a means of connection between the output device 840 and the system bus 818. It should be noted that other devices and/or systems of devices provide both input and output capabilities such as remote computer(s) 844.

Computer 812 can operate in a networked environment using logical connections to one or more remote computers, such as remote computer(s) 844. The remote computer(s) 844 can be a personal computer, a server, a router, a network PC, a workstation, a microprocessor based appliance, a peer device or other common network node and the like, and typically includes many or all of the elements described relative to computer 812. For purposes of brevity, only a memory storage device 846 is illustrated with remote computer(s) 844. Remote computer(s) 844 is logically connected to computer 812 through a network interface 848 and then physically connected *via* communication connection 850. Network interface 848 encompasses communication networks such as local-area networks (LAN) and wide-area networks (WAN). LAN

technologies include Fiber Distributed Data Interface (FDDI), Copper Distributed Data Interface (CDDI), Ethernet/IEEE 1102.3, Token Ring/IEEE 1102.5 and the like. WAN technologies include, but are not limited to, point-to-point links, circuit switching networks like Integrated Services Digital Networks (ISDN) and variations thereon, packet switching networks, and Digital Subscriber Lines (DSL).

Communication connection(s) 850 refers to the hardware/software employed to connect the network interface 848 to the bus 818. While communication connection 850 is shown for illustrative clarity inside computer 812, it can also be external to computer 812. The hardware/software necessary for connection to the network interface 848 includes, for exemplary purposes only, internal and external technologies such as, modems including regular telephone grade modems, cable modems and DSL modems, ISDN adapters, and Ethernet cards.

What has been described above includes examples of the present invention. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the present invention, but one of ordinary skill in the art may recognize that many further combinations and permutations of the present invention are possible. Accordingly, the present invention is intended to embrace all such alterations, modifications, and variations that fall within the spirit and scope of the appended claims.

In particular and in regard to the various functions performed by the above described components, devices, circuits, systems and the like, the terms (including a reference to a "means") used to describe such components are intended to correspond, unless otherwise indicated, to any component which performs the specified function of the described component (*e.g.*, a functional equivalent), even though not structurally equivalent to the disclosed structure, which performs the function in the herein illustrated exemplary aspects of the invention. In this regard, it will also be recognized that the invention includes a system as well as a computer-readable medium having computer-executable instructions for performing the acts and/or events of the various methods of the invention.

In addition, while a particular feature of the invention may have been disclosed with respect to only one of several implementations, such feature may be combined with

one or more other features of the other implementations as may be desired and advantageous for any given or particular application. Furthermore, to the extent that the terms "includes," and "including" and variants thereof are used in either the detailed description or the claims, these terms are intended to be inclusive in a manner similar to

5 the term "comprising."